

OUR ASTRONOMICAL COLUMN.

PERIODICAL COMETS DUE TO RETURN THIS YEAR.—In a letter to the *Observatory* (No. 405, January, p. 56) Mr. Lynn directs attention to the periodical comets which may be re-discovered during the current year.

Halley's comet cannot be reckoned among those of 1909, for its perihelion passage does not take place until next year, but it seems likely that it will be re-discovered, at least photographically, before the present year closes.

The only short-period comet likely to be re-observed is that generally known as Winnecke's, because he, after re-detecting it in 1858, proved its identity with the object discovered by Pons in 1819. The period is about $5\frac{1}{2}$ years, and it was re-observed in 1869, 1875, 1886, 1892, and 1898; on the latter occasion it passed perihelion on March 20, so it should become observable early this year. In 1880 and 1903 it was unfavourably situated, and was not seen.

THE CHANGES IN THE TAIL OF MOREHOUSE'S COMET.—In No. 4297 of the *Astronomische Nachrichten* (p. 1, January 9) Prof. Max Wolf discusses the forms and motions which successively occurred in the tail of comet 1908c, as shown by measurements of photographs taken at the Heidelberg Observatory.

Prof. Wolf gives the results of his measures of pairs of photographs taken at definite intervals, and shows that the matter forming the tail appears to have been expelled in waves, these waves being shorter than the similar ones seen in Daniel's comet. The length of these waves appears to be approximately proportional to their distance from the nucleus, whilst their amplitude is still nearer proportional to their distance.

Examined in the stereoscope, these wave-forms take a screw-like appearance, the south-eastern edge of each condensation or cloud appearing to be nearer to the observer than the north-western edge. In general, the measures show that recognisable condensations travelled with a greater velocity as they receded further from the head.

THE MAGNETIC FIELD IN SUN-SPOTS.—In No. 4, vol. xxviii., of the *Astrophysical Journal* Prof. Hale publishes a full discussion of the recent work which led him to recognise the existence of powerful magnetic fields in sun-spots.

As previously described in *NATURE* (August 20, 1908, No. 2025, p. 368), these fields were demonstrated by the appearance of the Zeeman effect in connection with certain lines in the sun-spot spectrum. Subsequent work has amply confirmed the conclusions then arrived at, and one or two difficulties have been removed. One of these difficulties was that certain doublets did not appear as triplets even when the spot was as much as 60° from the centre of the sun; another was that the iron line at λ 6302.71 appeared as an asymmetrical triplet in the spot spectrum, and was accordingly classed as a doublet with an interfering line of some other element. Work on laboratory spectra, carried out by Dr. King, has, however, shown that these apparent anomalies occur in the terrestrial spectra, and are therefore real phenomena due to the magnetic field.

THE SPECTRUM OF MARS.—The occurrence of the a water-vapour band in the spectrum of Mars, previously reported briefly, is discussed at some length by Mr. Slipher in the December (1908) number of the *Astrophysical Journal* (vol. xxviii., No. 5, p. 397), and illustrated by reproductions of the convincing spectra obtained by the author at the Lowell Observatory.

Previous investigators of the question of water-vapour bands in the Martian spectra have been at a loss because, whilst visual observations were necessarily unconvincing, photographic observations of the most suitable region of the spectrum, the a band, were very difficult. Mr. Slipher used especially bathed plates, which gave good spectra of this region, and by taking a comparison spectrum of the moon on the same plate, with the altitudes of the planet and the moon approximately the same, he obtained indubitable evidence that water-vapour plays an important part in the planet's absorption.

The photographs reproduced show the reinforcement of the a band in the spectrum of the "low sun" as com-

pared with the "high sun," and then show the strong reinforcement of this band in the spectrum of Mars as compared with that of the moon; whilst, on the photographs compared, the other lines and bands of the Martian spectrum are generally weaker than they are in the moon, the a band is, without any question, appreciably stronger.

More observations are necessary before the amount of water-vapour in the planet's atmosphere can be stated, but the results favour the existence of "snow caps" and a moderate temperature rather than "hoar-frost caps" and a low temperature for Mars.

A BRILLIANT METEOR.—Mr. P. Evans, of Kettering, reports that he observed a brilliant meteor at that place on January 11. The object appeared at 8h. 10m. p.m., its head being very bright, "like burning magnesium," and followed by a tail 10° or 15° long; Mr. Evans adds that the meteor was seen low down in the west, and travelling in a southerly direction.

CAMELOPARDALIS, CAMELOPARDALUS, OR CAMELOPARDUS?—Prof. E. C. Pickering devotes Circular No. 146 of the Harvard College Observatory to a discussion of the proper spelling of the name of this constellation, named by Hevelius in 1690, in order that a uniform spelling may be rigidly adopted by astronomers when making references to it.

After consulting the classical, zoological, and astronomical authorities, he concludes that the correct spelling is *Camelopardalis*.

REPORT ON AFFORESTATION IN THE UNITED KINGDOM.

THE second report (on afforestation) of the Royal Commission appointed to inquire into and to report on certain questions affecting coast erosion, the reclamation of tidal lands, and afforestation in the United Kingdom has just been published as a Blue-book (Cd. 4460, price 6d., Wyman and Sons, Ltd., 109 Fetter Lane, E.C.).

It will be remembered that in March, 1908, the terms of reference of the Royal Commission on Coast Erosion were extended so that the commission should inquire and report "Whether in connection with reclaimed lands or otherwise, it is desirable to make an experiment in afforestation as a means of increasing employment during periods of depression in the labour market, and if so by what authority and under what conditions such experiment should be conducted."

We propose to discuss the report later, and only give now the summary of the conclusions of the commissioners.

SUMMARY OF PRINCIPAL CONCLUSIONS.

(1) The natural conditions of soil and climate in the United Kingdom are favourable to the production of high-class commercial timber such as is annually imported into the country in very great quantities.

(2) The afforestation of suitable lands in the United Kingdom, if undertaken on an adequate scale and in accordance with well-recognised scientific principles, should prove at present prices a sound and remunerative investment.

(3) In estimating the profits of silviculture account must, moreover, be taken of two facts, the increasing consumption of timber per head of population all over the world, in spite of the introduction of alternative materials, and, further, the exploitation, waste, and destruction by fire of the virgin forests, especially those yielding the more important building timbers. Already a noticeable shortage of timber supply has resulted, as is evidenced by steadily rising prices and depreciating qualities in all markets. It seems impossible to escape from the conclusion that this tendency will be continued and accentuated, and that a steady and a very considerable rise in prices may be looked for throughout the present century. The security which afforestation offers for investment is therefore likely to be an improving one, with a corresponding increase in profits, but, to avoid all that is speculative, this prospect has been disregarded in framing our estimates.

(4) The amount of land suitable for afforestation, but not now under timber, in the United Kingdom may roughly

be put at a maximum of 9,000,000 acres. In determining this figure two considerations have been taken into account, besides elevation and physical suitability of soil. The first is that the value of the land is not in excess of a sum on which a fair return may be anticipated on the expenditure. This will naturally vary according to the productive capacity of the soil and the crop which it will carry. The second consideration is that the land could not be more profitably utilised in any other way.

(5) A forest of 9,000,000 acres, in which are represented the various series of age-classes, may be expected to yield 9,000,000 loads annually in perpetuity. The importation of foreign timber from temperate climates into the United Kingdom in the year 1907 exceeded 8,500,000 loads, or approximately the annual supply which could be expected from the afforestation of the above-mentioned area.

(6) The withdrawal of 9,000,000 acres from its present uses would cause some gradual curtailment of food supplies and displacement of labour. Land suitable for afforestation is mostly devoted to the production of mutton. Calculations on the basis of the present consumption show that at most 60,000 tons, or 4.8 per cent. of the total home production of meat, or 2.6 per cent. of the present national consumption, would be ultimately displaced. As to labour, the employment furnished by the present uses, mostly sheep farming, to which the land in question is devoted, may be taken to average one man to 1000 acres. This does not represent one-tenth of the permanent employment afforded by the maintenance of a similar area of land under forest.

(7) Systematic silviculture aims at the production of a steady and continuous supply of marketable timber. To ensure the maintenance of these supplies the area should be divided for planting by the average number of years which the crop needs to mature; for example, if the life of the crop be taken as eighty years, the area to be afforested every year would, out of a total area of 9,000,000 acres, be 112,500 acres. But a more rapid system of planting may be adopted without seriously complicating the rotation, and further, some adaptation to the temporary fluctuations of the labour market is feasible.

(8) The distribution of this 9,000,000 acres of suitable land is somewhat irregular. By far the largest areas are to be met with in the west and north of England, and throughout similar regions in Scotland. Ireland and Wales also contain a relatively large amount of this type of land. In the south and east of England, on the other hand, the areas in the aggregate are less extensive. Great diversity exists in the size of these areas, some counties offering large contiguous stretches, while in others the areas are characterised by their discontinuous nature.

(9) The administration of national forest lands should be entrusted to special commissioners.

(10) In dealing with these lands, subdivision into distinct districts, with an executive and administrative subcentre, commends itself from various points of view. Thus local employment would be afforded, local subsidiary industries would be encouraged, public recreation grounds would be provided, and, in connection with the establishment of such forests, small holdings would undoubtedly be multiplied.

(11) Silviculture in the United Kingdom is an enterprise which rarely appeals to the private landowner or capitalist. The prolonged time for which capital must be locked up before any return can be expected, the loss of rent and burden of rates over the whole period, and the absence of security for continuous care and management, act as deterrents. None of these objections applies to the State, the corporate life and resources of which lend themselves in an especial degree to an undertaking of this character. If the State plants, it will certainly reap, which the individual owner can rarely hope to do.

(12) If afforestation be promoted on a large scale the provision of suitable lands is the first step. For this purpose a general survey should be made, and the extent and distribution of such lands ascertained. As a rule, it will be found expedient for the State to purchase from time to time such areas as are destined for planting, but some progress may conceivably be made along the lines of profit-sharing, in which case the owner would forego

the purchase price. Experience proves that, although much of the land required may be expected to be purchasable by voluntary treaty, yet compulsory powers would be necessary to facilitate transactions where voluntary treaty had broken down. The principle laid down in the Small Holdings Act of 1907 for the acquisition of lands should govern these proceedings as to arbitration, restrictions, and safeguards. Where private owners can satisfy the Forest Commissioners that they are able and willing to afforest under their supervision and to their satisfaction, and give an undertaking to that effect, compulsory powers should not be enforced against such owners so long as that undertaking is fulfilled.

(13) The value of land falling within the definition of "suitability" may be taken, except in rare instances, to lie between 2*l.* and 10*l.* freehold value; but the average value of suitable lands, including the necessary buildings and other preliminary equipment, may be taken as 6*l.* 10*s.* per acre, and the average cost of afforestation also at 6*l.* 10*s.* per acre. If 150,000 acres be annually taken in hand, a sum of about 2,000,000*l.* would be needed annually to finance the undertaking.

(14) Money expended in afforestation differs in kind from other calls on the national purse. It is a productive investment of capital. To provide this capital sum out of taxes would be an act of unprecedented generosity on the part of the present generation of taxpayers in favour of their posterity. No stronger justification for proceeding by loan than a reproductive outlay exists. The loan should be based on actuarial calculations showing initial cost, expenses of upkeep and management calculated at compound interest over the whole period, and the value of the property when fully matured. Such actuarial statements we have given, which show, for the full scheme, that, after allowing 3 per cent. compound interest on all the capital invested, the approximate equalised revenue would at the end of eighty years amount to 17,411,000*l.* per annum, while the value of the property might be expected to be 562,075,000*l.*, or 106,993,000*l.* in excess of the sum involved in its creation. A smaller scheme, involving the afforestation of 6,000,000 acres (75,000 acres annually for eighty years), would show a profit of about 10,000,000*l.* annually, or a capital value of 320,000,000*l.*, being 60,944,000*l.* in excess of the cost of production.

(15) Coming to ways and means by which a loan of this character may best be provided, a point of great importance to be borne in mind is that, although the period of rotation of a timber crop may be taken as eighty years, yet, after forty years, owing to the value of thinnings and the receipts of some short-period crops, the forest becomes practically self-supporting. Between the fortieth and eightieth years, the sales of timber will be sufficient to meet the annual charges, including the upkeep and the extension of the forest. After the eightieth year a large annual revenue will be derived. These considerations point to a free loan from the Treasury to the Forest Commissioners; the net deficit to be met would in the first year be 90,000*l.* or 45,000*l.*, according to the extent of the operation, and would reach its maximum in the fortieth year, amounting in that year to 3,131,250*l.* or 1,565,625*l.* After this period the deficit would be insignificant, while in the eighty-first year the revenue derived would be 17,411,000*l.* or 10,000,000*l.* respectively, representing about 3½ per cent. on the total accumulated costs of the undertaking.

(16) On the question of labour and its relations to forestry, the conclusions to which the evidence before them leads your commissioners are that the operations involved in afforestation vary in the degree of requisite skill from little or none in rough road-making and surface draining to a considerable amount in the planting. Your commissioners wish to make it clear that they have in contemplation a scheme of national afforestation on economic lines. They have no hesitation in asserting that there are in the United Kingdom at any time, and especially in winter, thousands of men out of work for longer or shorter periods who are quite ready and able to perform the less skilled work without previous training, and with satisfactory results. There is a still larger class of unemployed who are capable of being trained to perform this or the

higher class of labour, and such men can, if desired, be recruited through labour colonies, distress committees, labour bureaux, or charitable agencies. There is, then, no need to accept inefficient labour with the object of affording occupation to the unemployed. The labour employed in the national forests should not fall below the ordinary standards, and should be remunerated at the ordinary rate of the district for similar labour. Subject to the requisite standard of efficiency being attained, preference should be given to those temporarily or permanently unemployed in the district, especially where evidence of such efficiency can be furnished by public or private agencies for the reclamation and training of the unemployed class.

(17) To establish afforestation on commercial lines does not, however, preclude its being used as an instrument of social regeneration. A broad view of economics cannot exclude from its cognisance the grave national charge which unemployment with all its concomitant results involves, to say nothing of the personal deterioration by which it is often accompanied. Sylviculture is not unsuitable for building up the moral and physical fibre of even the most depressed of the unemployed classes, and its agency may well be invoked for this purpose, and advantage taken of its healthy and wholesome influences, provided that any additional expense incurred by the employment of less efficient labour be defrayed from a separate account.

(18) In estimating the amount of employment furnished by afforestation, it is well to distinguish between the temporary labour involved in the creation of the forest and the permanent labour needed for its maintenance. Taking varying circumstances into consideration, it may be said that, on the average, it will take twelve men to afforest 100 acres in the planting season of four to five months, and that every 100 acres afforested will provide permanent employment for at least one man. If 150,000 acres be annually taken in hand, the labour of 18,000 men will be needed, and permanent employment will in due course be afforded to 1500 men, rising by an additional 1500 every year until the end of the rotation. The number permanently employed would then approach 100,000. The labour absorbed by felling and converting timber, to say nothing of subsidiary industries which spring up around a timber supply, has been considered too remote to warrant detailed estimation, but there is undoubtedly a large field of employment in this connection. It is important to remember that, on the basis of 1,000,000*l.* being annually spent on the operations of afforestation, apart from the cost of the land, employment would be afforded, directly and indirectly, to many more than 18,000 men. Indeed, the number employed may be roughly taken to be represented by about double that figure. For the incidental occupations, such as building, the making of implements, the provision of materials, &c., all involve the employment of additional labour.

(19) A special advantage of forestry in relation to labour is that it offers a new source of employment. The labour connected with timber and timber products imported into the country is performed abroad, and thousands of families are maintained on the produce of the labour associated with the timber industry. Another advantage bound up with the extension of sylviculture is that the market for its produce is so great that it is inconceivable that it could seriously interfere with the output from private woodlands, and no difficulty of competition between the State and individuals need be apprehended.

(20) The acquisition of grazing areas, private or common, for sylviculture might necessitate a modification of the existing agricultural system on certain farms. It is unreasonable to suppose that the remaining lowland areas on such farms could not, in many cases, either be adapted to other forms of agriculture or be profitably utilised for small holdings. Further, the conversion of comparatively unprofitable lands into forests enhances the productiveness of the adjacent areas, and should materially assist the small holdings movement. It has also the advantage of furnishing winter employment to small holders.

SCIENCE MASTERS IN CONFERENCE.

THE Association of Public School Science Masters held its ninth annual meeting at the Merchant Taylors' School on January 12, under the presidency of Sir Clifford Allbutt, K.C.B., F.R.S., who delivered an address entitled "The Function of Science in Education."

"If," he said, "our fathers looked out from a darker world upon a narrower dawn, it was upon an intenser light and a nearer vision than ours. We know better where we are, it is true; we can see more—we certainly run after more; but are we pressing as keenly forward on the line of promise? We are cutting and paving the road better for the throng upon the route; but the engineer who maps and makes the road may be too busy to regard the forerunners who, heedless of moss and rock, are crying to the multitude to cast aside every weight and race forwards to the light. Still, both prophet and engineer are needful to us, and it is a straight and business-like inquiry for men of science to ask themselves how far they are engineers, how far prophets."

"The home and the school should develop the service of the child, the imagination of the child, his intellect, and his ethics. Morals cannot yet be explained to him scientifically; the help of science to ethics will be recognised later. If scientific training does not generate the passion for righteousness, by its ordinances these aspirations are directed and fortified. Until the conceptions of modern science had permeated us, we had no full sense of the unity of society nor of our duty to our neighbour. As now the survival of the fittest has become an emulation, not of individuals, but of social groups, it is the most coherent groups which will govern the earth. In science may be discovered the sanctions of simplicity, sincerity, and brotherhood to chasten a luxurious age, such as in former times literature alone, even an Augustan literature, failed to regenerate."

"What do we mean by science? We do not contemplate experimental science only, we include the pristine idea of all orderly knowledge, of analysis of concepts for the construction of systems of affirmative propositions. There is no branch of education, or of the business of life for which it is to fit us, which science is not busily re-handling, re-modelling, and re-interpreting. This is not to say that the methods you and I represent are to become sole masters of mankind. Action may be sicklied o'er by too much thought, by too much analysis, and herein is engendered that distrust—reasonable and unreasonable—which the humanist has always felt of the man of science. The humanist winces to see the flower of literature stiffened into a diagram. My point of view demands the pursuit of what is called 'classical' culture, not as in itself education, but as a constituent of education."

"The British boy, generically speaking, is a very matter-of-fact little person; very serious, very curious, and very handy. It is from his great example *man* that he may learn flippancy, satiety, mental inertia. In our educational methods do we foster the precious seriousness of the boy? Do we feed his curiosity, or do we snub and disgust it, so that when he leaves school all or much of his natural ardour for knowledge is blighted? All school-masters must learn, what the science-master can teach them, that, if by his own hands the boy can contrive no great art, yet it is immediately by promoting the activity and precision of his nervomuscular system that nature is building up, not his practical brain only, but also much of the hive of his mind—not to mention the congruities of bodily sanity. The boy will tolerate drudgery if his seriousness is not fatigued, and if his eyes are lifted continually over the dry intermediate task to realise what he is to see at the end of the hard high road. He must be led, not only to do the right things, but also to enjoy them. (By the way, is there a public-school playing-field in England which has been accurately surveyed and mapped by the boys?) The boy's curiosity might be better cherished by a more comprehensive literary outlook. By the new history, the new archaeology, the new geography, the 'classics' are indeed becoming more of a living subject; we are bold enough to claim that it is by science that these changes have been wrought, and that, with-